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Mortality in Belarus, Lithuania, and Russia: Divergence in Recent Trends and Possible Explanations

La mortalité en Biélorussie, Lituanie et Russie: Divergence dans les Tendances Récentes et Explications Possibles

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Abstract Before the collapse of the Soviet Union, Belarus, Lithuania, and Russia were quite comparable in terms of their socioeconomic development. Despite some differences in overall mortality levels, the three former Soviet republics were also very close to each other in terms of directions of mortality trends and age- and cause-specific mortality patterns. After 1991, all the three countries experienced substantial political and social transformations, and the challenges associated with the transition from a socialist to a market economy system. The sudden changes brought numerous problems, such as rapid growth in unemployment, falling standards of living, and growing social and income inequalities. These factors contributed to the significant deterioration of the health situation in all the countries, but the size and the nature of the mortality crisis was different in Belarus than it was in Lithuania and Russia. The marked similarities in socioeconomic and mortality trends in the countries up to 1991 contrast with their notable divergence during the subsequent years. The nature and success of market reforms seems to be the most plausible explanation for these differences. Russia and Lithuania have chosen more radical forms of economic and political transformations, which have led to massive privatization campaigns. The reforms were more sustainable and systematic in

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Lithuania than in Russia. By contrast, Belarus has chosen a gradual and slow transition path. Recent mortality trends in Belarus are explored in detail here, and are contrasted with those observed in Lithuania and Russia. Including a cause-of-death analysis sheds more light on the plausible determinants of the variations in mortality levels between the countries.

Keywords Belarus · Lithuania · Russia · Mortality trends · Causes of death · Market reforms · Socioeconomic changes

Résumé Avant la chute de l'Union Soviétique, la Biélorussie, la Lituanie et la Russie étaient tout à fait comparables en termes de développement socio-économique. En dépit de quelques différences de taux de mortalité générale, les ex-Républiques Soviétiques étaient également très proches en termes de tendances et de variations de la mortalité par cause et par âge. Après 1991, les 3 pays ont connu des bouleversements politiques et sociaux, et ont dû faire face aux défis associés au passage d'une économie socialiste à l'économie de marché. Ces changements soudains ont provoqué de nombreux problèmes, tels qu'une montée rapide du chômage, la baisse du niveau de vie et le développement d'inégalités sociales et de revenu. L'ensemble de ces facteurs a contribué à une détérioration significative de la situation sanitaire dans tous les pays, mais la crise de mortalité en Biélorussie était différente de celles de la Lituanie et de la Russie, à la fois en termes d'étendue et de nature. Les grandes similitudes des tendances socio-économiques et de mortalité dans ces pays jusqu'en 1991 contrastent avec leur divergence notable au cours des années qui ont suivi. La nature et le succès des réformes liées au passage à l'économie de marché est l'explication la plus plausible de ces différences. La Russie et la Lituanie ont choisi des formes plus radicales de transformation économique et politique, qui ont mené à des campagnes de privatisation massives. Les réformes étaient plus durables et systématiques en Lituanie qu'en Russie. La Biélorussie, en revanche, a choisi la voie d'une transformation graduelle et lente. Les tendances récentes de la mortalité en Biélorussie sont examinées en détail dans cette étude, et comparées à celles observées en Lituanie et en Russie. Une analyse des causes de décès éclaire sur les déterminants plausibles des variations de niveau de mortalité entre ces pays.

Mots-clés Biélarussie · Lituanie · Russie · Tendances de la mortalité · Causes de décès · Réformes du marché · Changements socio-économiques

1 Introduction

Unfavorable mortality trends in the former Soviet republics have attracted the attention of many researchers. The increase in mortality observed in the former USSR, and, after its collapse, in the New Independent States (NIS), represents a trend that is unprecedented in peacetime, and has thus stimulated extensive research. As a result, several kinds of explanations for the recent mortality crisis have been

proposed, each tending to complement rather than contradict the others. The most straightforward, widespread, and well documented of them is that excessive alcohol consumption has had a strong influence on life expectancy at birth (Anderson and Silver 1990; Meslé et al. 1992; Shkolnikov and Nemtsov 1997; Shkolnikov et al. 1998). Alcohol is known to be directly associated not only with violent mortality, but also with other causes of death. Research has demonstrated that heavy alcohol consumption has been an important determinant of cardiovascular mortality in the region (McKee and Britton 1998; Malyutina et al. 2002). A number of very recent epidemiological case–control studies conducted in some cities of Russia have shown that mortality among the working-age population is strongly associated with high-risk patterns of alcohol consumption (Leon et al. 2007; Zaridze et al. 2009). However, while alcohol plays an important role as both an immediate and an intermediate mortality determinant, it is far from being the only driver of the recent health crisis. There are additional explanations linked to the abrupt political changes that triggered a very severe socioeconomic crisis, particularly in Russia (Meslé et al. 2000, 2003). Unemployment growth, the erosion of the social security system and of the health sector, falling living standards, and growing income inequality are viewed as determinants of psychological stress and unhealthy behavioral patterns, which in turn have a negative impact on the health status of the population (Bobak et al. 1998, 2000; Cockerham et al. 2006; Cornia and Paniccia 2000). Other theories regarding the mortality crisis, such as declining standards of medical care and changes in dietary habits, have not received substantial support (Brainerd and Cutler 2005). Furthermore, the recent negative mortality dynamics cannot be fully attributed to the above-mentioned factors only. First, the health crisis in the former Soviet republics is known to be the long-standing; it emerged well before the collapse of the USSR (Eberstadt 1981; Feshbach 1984; McKee 2006). Until the early 1960s, life expectancy at birth in the USSR was growing and catching up with that of the Western world. The Soviet health care system was very successful in combating infectious diseases, but less effective against non-communicable diseases. In particular, unlike Western countries, the Soviet Union failed to benefit from the "cardiovascular revolution" (i.e., the steady reduction in cardiovascular mortality, which was unanticipated and revolutionary from the viewpoint of the classical theory of epidemiologic transition; Omran 1972). In the mid-1960s, cardiovascular diseases became the major cause of death, and mortality from accidents and other external causes was unusually high. From that time onwards, the USSR experienced a dramatic reversal on the path toward declining mortality, a trend which was especially pronounced in working-age men. Second, mortality trends in the early 1990s might have still been affected by the inverse effect of the anti-alcohol campaign launched by the Soviet government in 1985. To sum up, the literature suggests that the mortality trends in the region seem to be influenced by the interplay of three major factors: the long-standing health crisis that began in the USSR several decades ago, the effects of the anti-alcohol campaign, and the socioeconomic and political changes that emerged with the dissolution of the USSR.

Our study focuses on the divergence in the recent mortality trends in the countries of the former USSR. To explore the potential mechanisms of such a divergence, we purposely selected three very contrasting cases in terms of the recent

socioeconomic and demographic developments: Belarus, Lithuania, and Russia. Before the dissolution of the Soviet Union, these countries were quite comparable in terms of economic performance and living standards. Despite some differences in overall mortality levels, they were also very close to each other in terms of directions of mortality trends and age- and cause-specific mortality patterns. After 1991, Belarus, Lithuania, and Russia experienced substantial political and social transformations, and faced multiple challenges associated with the transition from a socialist to a market economy system. The sudden changes brought numerous problems, such as unemployment, falling living standards, a rise in poverty, and socioeconomic differentiation. These factors contributed to the significant deterioration in the already poor health situation (Cockerham 1997), but their magnitude and impact on the mortality crisis differed from country to country. It is interesting that marked similarities in socioeconomic and mortality trends among countries up to 1991 contrast with notable divergence over the subsequent years. In the early 1990s, Russia and Lithuania chose more radical forms of economic and political transformations, which led to massive privatization campaigns and to the establishment of fully functioning market economies. The reforms were more sustainable and systematic in Lithuania than in Russia, where rapid liberalization was implemented without creating strong market institutions (Popov 2007). In 2004, Lithuania entered the European Union after making the changes necessary for entry. By contrast, Belarus has chosen a gradual and slow transition path, maintaining many of the key features of the old-fashioned planned economy established during the Soviet era. Under such circumstances, the most plausible explanation for the diverging mortality trends seen in Belarus, Lithuania, and Russia is provided by the different modalities and unequal success of the market reforms, which are known to have influenced mortality trends in transition countries (Brainerd 1998; Sachs 1996; Shapiro 1995; Stuckler et al. 2009).

Our study aims to explore and understand the potential causes of the variations in mortality levels between the selected countries. It is organized as follows. First, we analyze general mortality trends in the countries so that major phases of the divergence process can be determined. Next, we perform a demographic analysis to explore the changes that have occurred in cause-specific mortality patterns within and between the three countries. Finally, the analysis of available socioeconomic indicators provides us with an opportunity to suggest possible explanations for the divergence in recent mortality trends in Belarus, Lithuania, and Russia.

2 Data and Methods

The analysis focuses on males because they have been much more severely hit by Soviet and post-Soviet health crises than females. It covers the period 1990–2005 for three former Soviet republics: Russia, Belarus, and Lithuania. The study is based on mortality data obtained from the Human Mortality Database (HMD),[1] the

[1] http://www.mortality.org/.

European Health for All Database (HFA-DB),[2] original statistical data on causes of death, and available aggregated data on economic indicators obtained from TransMonee Database,[3] and World Income Inequality Database (WIID2).[4] The data on the economic indicators include such indicators as Gross Domestic Product at purchasing power parity per capita (GDP per capita $PPP), and the Gini coefficient. Unlike mortality data, the reliability, consistency, and comparability of data on socioeconomic development are very questionable. They are collected from different sources, and do not always follow the same methodology. This is especially the case for the early 1990s, or the first transitional years, which were also very challenging for statistical systems. The new reality called for a reconsideration of methodological approaches to data collection. The problem of coverage and completeness of registration (emerging private enterprises, "hidden economy," etc.) was complicated by a number of other challenges, such as hyperinflation. All these eventually affected the quality of estimates of real GDP and other important macroeconomic indicators. For the above-mentioned reasons, the socioeconomic data seem to be rather insufficient for building sophisticated statistical models. Nonetheless, if used with caution, they can still complement the demographic analysis, and may shed more light on the complex relationship between socioeconomic changes and mortality.

A few remarks regarding the quality of mortality data are also worth making here. There are reasonable concerns that the two Chechen wars as well as return and labor migration might have a significant impact on the level of male life expectancy in Russia. Nevertheless, we have reasons to assume that these possible distortions do not have a notable impact on mortality dynamics. First of all, over the period 1993–2002, the territory of the Chechen Republic was excluded from Russian vital statistics (Shkolnikov and Jdanov 2006). Life expectancy estimates for this period do not account for the war losses among the Chechen population. Secondly, it can be also assumed that return migration was adequately covered by the system of vital statistics. Russian repatriates determined immigration flows in Russia in the 1990s. According to official statistics, during 1989–2004, more than 3 million ethnic Russians migrated from other former Soviet republics to Russia. More than half of them (1.8 million) emigrated during 1992–1995 (Annual Demographic Report 2006). Presumably, since repatriates moved for permanent residence, they were registered by local authorities. Finally, although the registration of vital events concerning temporary labor migrants is biased (while not included in the population at risk (exposure) a migrant whose death occurred in Russia is registered by Russian authorities), it should not lead to a significant overestimation of the mortality level. To make such a conclusion, we analyzed the unpublished data of the Central Statistical Office of Russia on the number of deceased by country of permanent residence. For example, in 2005, the number of deceased having foreign (non-Russian) origin constituted approximately 0.5% of the total number of deaths that

[2] http://www.euro.who.int.

[3] http://www.unicef-irc.org.

[4] http://www.wider.unu.edu.

occurred in Russia. This share varied slightly by sex and age within the range of 0.4–0.7%.

Overall, most experts who deal with mortality data for Russia, the Baltic States, and Belarus agree that the registration of deaths in these countries is complete (Murray and Bobadilla 1997). Anderson and Silver (1997) note that recent mortality data for these countries "are generally trustworthy, especially at the working ages." On the basis of death registration data (1981–2001), the World Health Organization (WHO) ranks Belarus and Russia as countries with mortality data of medium quality, and Lithuania as a country with high-quality mortality data. The WHO assessed the completeness of the death registration (i.e., the proportion of all deaths that are registered among the population covered by the vital registration system of the country) to be 100% in each country. The coverage of death registration (i.e., the total number of deaths recorded by the vital registration system for a given year, divided by the total number of deaths estimated by the WHO for that year) has been estimated to be 98% in Belarus, 97% in Lithuania, and 100% in Russia (Mathers et al. 2005). For more details regarding the data-quality issues in the three countries, such as territorial coverage, the implementation of the WHO definition of live birth, etc., see Grigoriev (2008), Jasilionis and Stankuniene (2008), and Shkolnikov and Jdanov (2006).

Given the objective of our study and data-quality considerations, we decided to adopt the descriptive approach. Conventional demographic methods, such as the life table decomposition technique (Andreev 1982), are widely employed in analyzing mortality trends. This method enables us to determine precisely the ages and causes of death responsible for changes in life expectancy at birth over time, and between countries.

3 General Mortality Trends

Prior the collapse of the USSR, the directions of the mortality trends in Belarus, Lithuania, and Russia were very similar (Fig. 1). Over the entire period of 1965–1990, levels of life expectancy at birth[5] in Belarus and Lithuania were almost the same, and exceeded that of Russia.

In the mid-1980s, all countries experienced significant improvements, which are attributable to the effect of the anti-alcohol campaign (Shkolnikov and Nemtsov 1997). The anti-alcohol campaign seemed to be slightly more beneficial for Russia: between 1984 and 1986, male life expectancy in this country increased by 3.1 years, compared with 2.3 years in Lithuania and 2.6 years in Belarus. Subsequently, life expectancy trends again started to deteriorate. Seemingly, the life expectancy trends in the late 1980s were driven by the inverse effect of the campaign, which ended in 1987. The Chernobyl disaster, which occurred in 1986, may also have had an impact

[5] HMD estimates of life expectancy are not adjusted to the change in the registration of infant mortality that occurred in the USSR in the middle of 1970s (see Anderson and Silver 1986). The registration of infant mortality prior to this time was incomplete, which resulted in a moderate overestimation of life expectancy (Meslé et al. 2003). We assumed that the magnitude of such an overestimation was about equal in each of the three countries, and we therefore did not make any adjustments to life expectancy.

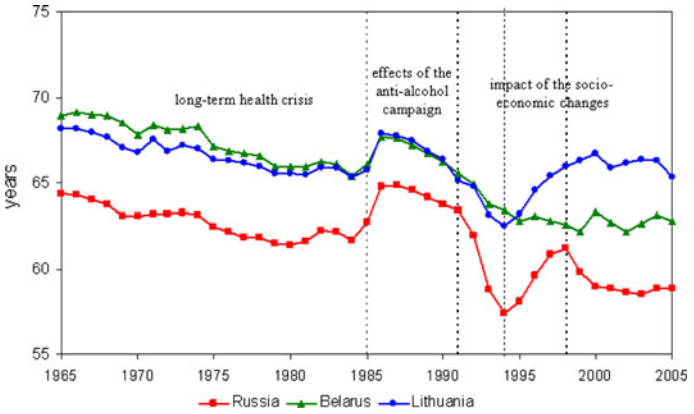

Fig. 1 Male life expectancy at birth in Russia, Belarus, and Lithuania; 1965–2005. *Source*: Human Mortality Database (HMD). *Note*: during 1993–2002 the territory of the Chechen Republic was not covered by vital statistics of Russia (Shkolnikov and Jdanov 2006)

on mortality trends. This impact would be especially noticeable for Belarus, which was among the countries most affected by the aftermath of the Chernobyl accident. However, according to the comprehensive report of the Chernobyl Forum[6] "… there is no clearly demonstrated increase in the incidence of solid cancers or leukemia due to radiation in the most affected populations. …It is impossible to assess reliably, with any precision, numbers of fatal cancers caused by radiation exposure due to the Chernobyl accident… The projections indicate that, among the most exposed populations (liquidators, evacuees and residents of the so-called 'strict control zones'), total cancer mortality might increase by up to a few per cent owing to Chernobyl related radiation exposure. Such an increase could mean eventually up to several thousand fatal cancers in addition to perhaps one hundred thousand cancer deaths expected in these populations from all other causes. An increase of this magnitude would be very difficult to detect, even with very careful long term epidemiological studies" (Chernobyl Forum 2006). Thus, even the dramatic environmental and health consequences of the Chernobyl accident did not seem to influence life expectancy trends in the three countries. In general, the period between 1980 and 1990 can be characterized as a period of gradual convergence of mortality trends between Russia on one hand, and Belarus and Lithuania on the other, with Russia slowly catching up the other two countries. While in 1980, the difference in male life expectancy between them was more than 4 years, by 1990 this gap was reduced to about 2 years.

The divergent mortality trends observed since 1990 deserve particular attention. They can be divided into three main stages. The first, from 1990 to 1994, was characterized by a rapid mortality increase, but the magnitude of the negative

[6] The Chernobyl Forum is the name of a group of UN agencies, founded on 3–5 February 2003 at the International Atomic Energy Agency (IAEA) Headquarters in Vienna, to scientifically assess the health effects and environmental consequences of the Chernobyl accident and to issue factual, authoritative reports on its environmental and health effects (source: http://en.wikipedia.org/wiki/Chernobyl_Forum).

Table 1 Age contributions to the change in male life expectancy at birth in Belarus, Lithuania, and Russia, by periods (years)

Age	Belarus			Lithuania			Russia		
	1990–1994	1994–1998	1998–2005	1990–1994	1994–1998	1998–2005	1990–1994	1994–1998	1998–2005
0	−0.05	0.04	0.39	−0.25	0.28	0.17	−0.13	0.17	0.38
1–4	0.02	0.00	0.06	0.00	0.08	0.04	−0.02	0.02	0.06
5–14	−0.05	0.05	0.05	−0.01	0.09	−0.02	−0.01	0.05	0.03
15–24	−0.10	0.01	0.16	−0.26	0.19	0.05	−0.41	0.06	0.11
25–34	−0.36	−0.10	−0.03	−0.54	0.39	−0.08	−0.89	0.42	−0.63
35–44	−0.51	−0.08	−0.14	−0.79	0.75	−0.11	−1.44	0.89	−0.75
45–54	−0.64	−0.18	0.04	−0.95	0.64	−0.11	−1.60	1.07	−0.84
55–64	−0.60	−0.29	−0.16	−0.70	0.65	−0.45	−1.13	0.73	−0.56
65–74	−0.35	−0.24	−0.09	−0.22	0.21	−0.10	−0.52	0.25	−0.16
75–84	−0.16	−0.02	0.00	−0.11	0.14	−0.01	−0.16	0.12	−0.01
85+	−0.04	0.00	−0.01	−0.02	0.02	−0.06	−0.04	0.03	0.01
Total	−2.84	−0.81	0.27	−3.85	3.44	−0.68	−6.35	3.81	−2.38

Source: own calculations based on the HMD data

changes differed from country to country. For example, between 1990 and 1994, male life expectancy in Belarus and Lithuania decreased by 2.8 and 3.9 years, respectively, while in Russia it decreased by 6.4 years (Table 1). Clearly, the mortality increase in all countries varied greatly with age. Whatever the causes of the mortality increase, the middle age groups were the most affected. Even though mortality among children and the elderly also rose between 1990 and 1994, the negative contributions of these groups to the life expectancy losses were much smaller. The relatively modest mortality increase among children and the elderly on one hand, and the sharp increase in working-age mortality on the other, suggest social causes played a more prominent role than biomedical ones (Cockerham 1997). Working-age males appeared to be more exposed not only to risky behavior patterns, but also to the negative consequences of the economic crisis in the beginning of the 1990s.

During the second stage (1994–1998), life expectancy at birth rose in all countries except Belarus, where it decreased steadily. Symmetrically to the previous period, the working-age population benefited the most from the life expectancy increase in Russia and Lithuania.

During the third stage (1998–2005), the trends in life expectancy in the three countries did not reveal such drastic fluctuations as in the previous years.

In Russia, mortality again increased rapidly until 2000—which might be explained by the consequences of the Russian financial crisis in 1998 (Gavrilova et al. 2000)—and then stabilized. In Lithuania, the decrease in mortality slowed around 2000, and life expectancy stagnated and even declined in 2005, raising some doubts about the sustainability of the improvement in health. Finally, in Belarus,

mortality trends contrasted with those seen in the other two countries by avoiding acute fluctuations, but persisting in a more regular deterioration without any significant improvement since 1998. Trends in Belarus appear to still be driven by long-standing negative factors, and not by specific consequences of the transition period.

4 Changes in Cause-Specific Patterns of Mortality

4.1 Data on Causes of Death

Studying cause-specific patterns of mortality can provide us with a better understanding of overall mortality dynamics. Mortality from certain causes of death is correlated with specific risk factors and behavioral patterns. Thus, the analysis of causes of death plays a vital role in establishing causal links between mortality and its determinants.

Unfortunately, such an analysis is complicated by the changes made in the revisions of the International Classifications of Diseases (ICD). Since 1990, several different classifications of causes of death introduced in different years have been used in Belarus, Lithuania, and Russia. Specifically, in 2002, Belarus shifted from the 1981/1988 Soviet classification of causes of death[7] to ICD-10 (a specific abridged version). While Lithuania adopted the ICD-10 much earlier, in 1998, the Soviet classification of 1981/1988 was in use until 1992, and was then replaced by ICD-9 (1993–1997). Finally, in 1999, the last Soviet classification was replaced in Russia by a specific abridged version of the ICD-10.

Ideally, to fill in the breaks in the statistical series due to changes in the cause-of-death classification, a precise reconstruction method should be applied (Meslé et al. 1992; Meslé and Vallin 1996). However, such a time-consuming method can be replaced by a rough grouping of classification items that make it possible to capture major changes in cause-specific mortality by dealing with very broad groups of causes. The seven selected groups of causes and their correspondence to the different classifications are presented in Table 2.

4.2 Life Expectancy Changes by Periods

Age and cause components of observed changes in male life expectancy at birth during three periods in Belarus, Lithuania, and Russia are presented in Table 3. They underline the key role of circulatory diseases and external causes in changing mortality levels over the selected periods. Indeed, the highest contributions to the decrease in life expectancy in Belarus and Russia over the whole period 1990–2005 were from diseases of the circulatory system (−2 years in Belarus, −2.4 in Russia), followed by external causes in second position (−1.4 and −1.9). However, different patterns emerge for the three sub-periods studied here. In particular, external causes were the most important factor in the deterioration between 1990 and 1994: 53% of

[7] Soviet classification of 1981 modified in 1988.

Table 2 Causes of deaths according to different classifications and their correspondence to items of the Soviet classification (1988), ICD-9 and ICD-10

Group of causes of death	Classification				
	Soviet classification (1988 revision)	ICD 10 (abridged list) used in		ICD9 (list B)	ICD10 (detailed list)
		Russia	Belarus		
Infectious diseases	1–44	1–55	1–58	B01–B07	A00–A99, B00–B99
Neoplasms	45–67	56–89	59–94	B08–B17	C00–C97, D00–D48
Diseases of the circulatory system	84–102	115–147	124–159	B25–B30	I00–I99
Diseases of the respiratory system	103–114	148–164	160–177	B31–B32	J00–J99
Diseases of the digestive system	115–127	165–179	178–193	B33–B34	K00–K93
External causes of death	160–175	239–255	256–277	B47–B56	V01–Y98
Other causes of death	68–83, 128–159	90–114, 180–227	95–123, 194–255	B18–B24, B35–B46	D50–H95, L00–R99
All causes	1–175	1–228, 239–255	1–277	B01–B56	A00–R99, V01–Y98

the overall decrease in male life expectancy was due to external causes of death in Lithuania, compared to 41% in Belarus and 45% in Russia. The impact of cardiovascular mortality was most pronounced in Belarus (43% of the overall decrease), followed by Russia (35%), but accounted for only 18% in Lithuania. During the intermediate period, when life expectancy in Russia and Lithuania made significant progress (and deteriorated slightly in Belarus), the effects of circulatory diseases and external causes were almost the same. However, from 1998 to 2005, external causes had much less impact than cardiovascular diseases in the three countries.

Figure 2 illustrates the age-cause specific contributions to the change in male life expectancy in Belarus, Lithuania, and Russia over the three periods. From 1990 to 1994, even if the magnitude of the deterioration is much larger in Russia than in Belarus, the two age- and cause-specific patterns look very similar. Both external causes and cardiovascular diseases play major roles. While external causes mainly affect younger adult ages, cardiovascular diseases are more prevalent at older adult ages. The case of Lithuania is quite different. External causes of death not only have much more significant effects on the life expectancy decrease in Lithuania than in Belarus and Russia, but external causes are much more important at the youngest adult ages (20–34). Under age 45, the impact of cardiovascular mortality is relatively small. Also, unlike in Russia and Belarus, other causes of death

Table 3 Contributions of the selected causes of death to changes in male life expectancy at birth in Belarus (BLR), Lithuania (LTU), and Russia (RUS), by periods (years)

	1990–1994			1994–1998			1998–2005			1990–2005		
	BLR	LTU	RUS	BLR	LTU	RUS	BLR	LTU	RUS	BLR	LTU	RUS
Infectious diseases	−0.06	−0.15	−0.20	−0.03	0.05	0.01	−0.13	0.00	−0.15	−0.22	−0.09	−0.33
Neoplasms	−0.15	−0.12	−0.04	0.09	0.15	0.21	0.24	0.10	0.17	0.18	0.13	0.34
Diseases of the circulatory system	−1.21	−0.69	−2.23	−0.36	1.12	1.29	−0.38	−0.63	−1.50	−1.95	−0.21	−2.44
Diseases of the respiratory system	−0.06	−0.11	−0.42	0.00	0.15	0.37	0.17	−0.07	−0.16	0.11	−0.03	−0.22
Diseases of the digestive system	−0.05	−0.18	−0.27	−0.06	−0.06	0.12	−0.18	−0.25	−0.40	−0.30	−0.48	−0.54
External causes	−1.17	−2.03	−2.84	−0.46	1.23	1.50	0.22	−0.02	−0.57	−1.40	−0.82	−1.91
Other causes	−0.14	−0.57	−0.35	0.01	0.80	0.31	0.33	0.19	0.23	0.20	0.41	0.18
Total	−2.84	−3.85	−6.35	−0.81	3.44	3.81	0.27	−0.68	−2.38	−3.38	−1.09	−4.92

Source: own calculations based on original tables on causes of death and data from HMD

For Lithuania we used reconstructed time series by causes of death in accordance with ICD 10; ill-defined causes of death were proportionally redistributed among other causes

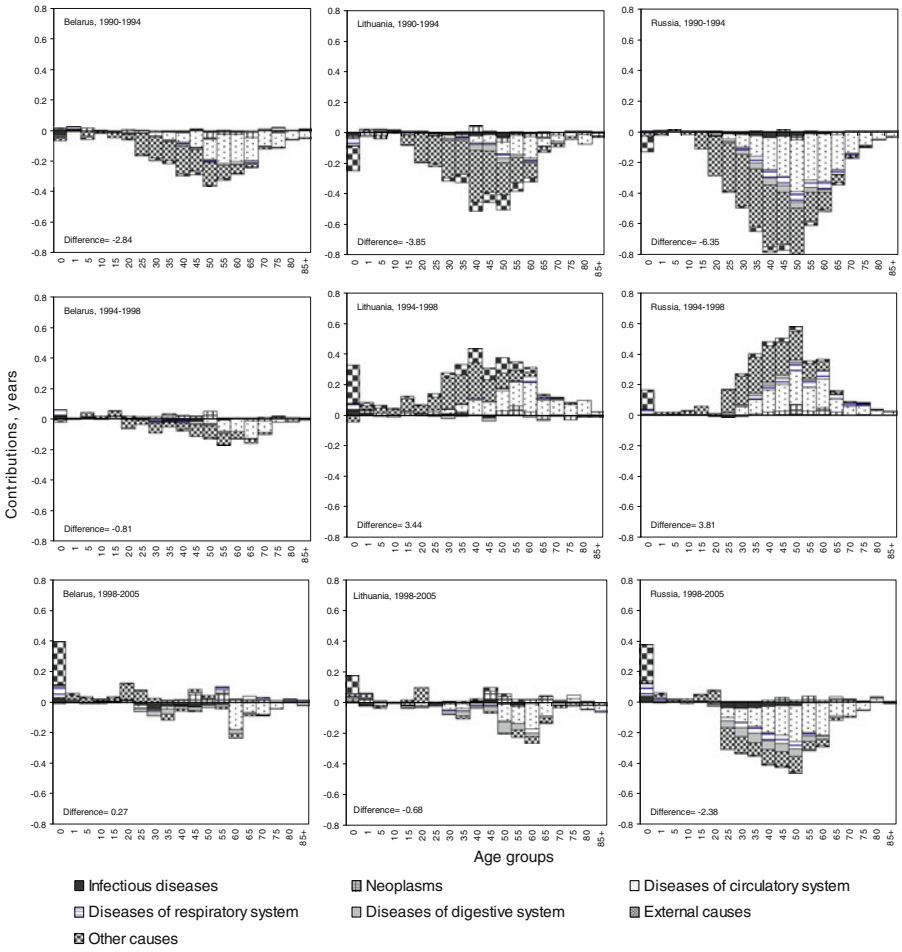

Fig. 2 Age-cause contributions to the change in male life expectancy at birth in Belarus, Lithuania, and Russia, by periods (years) *Source*: as in Table 3

(particularly at age 0) have played an important role in the deterioration of life expectancy in Lithuania.[8]

During 1994–1998, life expectancy in Belarus continued to deteriorate slightly, while Lithuania and Russia experienced considerable improvement. In the latter two countries, age- and cause-specific impacts are almost symmetrical when compared to the deterioration of the previous period. However, there is an important difference: in Lithuania, the positive role of cardiovascular diseases is more

[8] Levels of infant mortality increased substantially in Lithuania between 1990 and 1994, due mainly to the adoption of the WHO definition of live birth in 1991. Russia and Belarus adopted the WHO definition in 1993 and 1994, respectively. However, unlike in Lithuania, the WHO definition of live birth was not fully implemented in these counties. For more details, see Grigoriev (2008) and Shkolnikov and Jdanov (2006).

important than the negative role seen in the previous period (33% of the increase versus of 18% of the decrease); while in Russia, it is the reverse. Over the same period, the relative importance of younger adult ages in the positive role of external causes in Lithuania is more pronounced. In Belarus, as in the previous period, diseases of the circulatory system and external causes of death were mostly responsible for the continuing deterioration, but, compared to the 1990–1994 period, negative contributions shifted to older ages.

Between 1998 and 2005, more similarities are observed between Belarus and Lithuania, while Russia experienced much greater losses in life expectancy. Everywhere, the increase in cardiovascular mortality is the most important negative factor. While external causes still play an important role, they are no longer prominent, and all other causes are quite negligible in Belarus and Lithuania. In the three countries, the contrast between young people (under age 25) and older adults is more pronounced than ever. Belarus and Russia benefit from quite substantial gains due to the decrease in infant mortality. In addition, the reduction in external causes around age 20 brings some gains, especially in Belarus and Lithuania. As negative contributions at adult ages are still very large, a clear dividing line appears in Russia at age 25, with small gains but almost no losses at all ages below 25, and dramatic losses and almost no gains above that age.

4.3 Changes in Life Expectancy Differences Between Countries

Another way to capture the comparative effects of age- and cause-specific mortality changes is to compare life expectancy levels between countries at given points in time. Figure 3 depicts the comparison between Belarus and Russia, and Belarus and Lithuania, in 1990, 1994, 1998, and 2005. At the beginning of the study period, in 1990, the gap in male life expectancy between Belarus and Russia was mostly determined by three factors: infant mortality, much lower in Belarus than in Russia; external causes among youth and young adults (from ages 5 to 55); and, finally, diseases of the circulatory system at older ages.

The situation was quite different in 1994. Russia was severely hit by the dramatic socioeconomic crisis of 1992–1993, while Belarus managed to minimize its consequences. Infant mortality aside (for which Belarus maintains more or less the same advantage), the Belarus advantage was far bigger than in 1990, and the effects of external causes and cardiovascular diseases, while still dominant, are spread much more widely over the age groups. The impact of external causes is very strong from ages 15 to 55, while that of cardiovascular diseases is massive from ages 35 to 70, with a large overlap between these two groups of causes. The impact of other causes is quite negligible. After the Russian post-crisis recovery, in 1998, the gap in male life expectancy between Belarus and Russia almost vanished, becoming even smaller than it was in 1990. However, apart from infant mortality, the gap was exclusively due to external causes. The small impact of the difference in cardiovascular diseases is even to the advantage of Russia.

Russia then resumed its unfavorable long-term trends, and by 2005 the difference favored Belarus much more than at the beginning of the study (1990). All the complex changes seen over this often chaotic 15-year period resulted in an

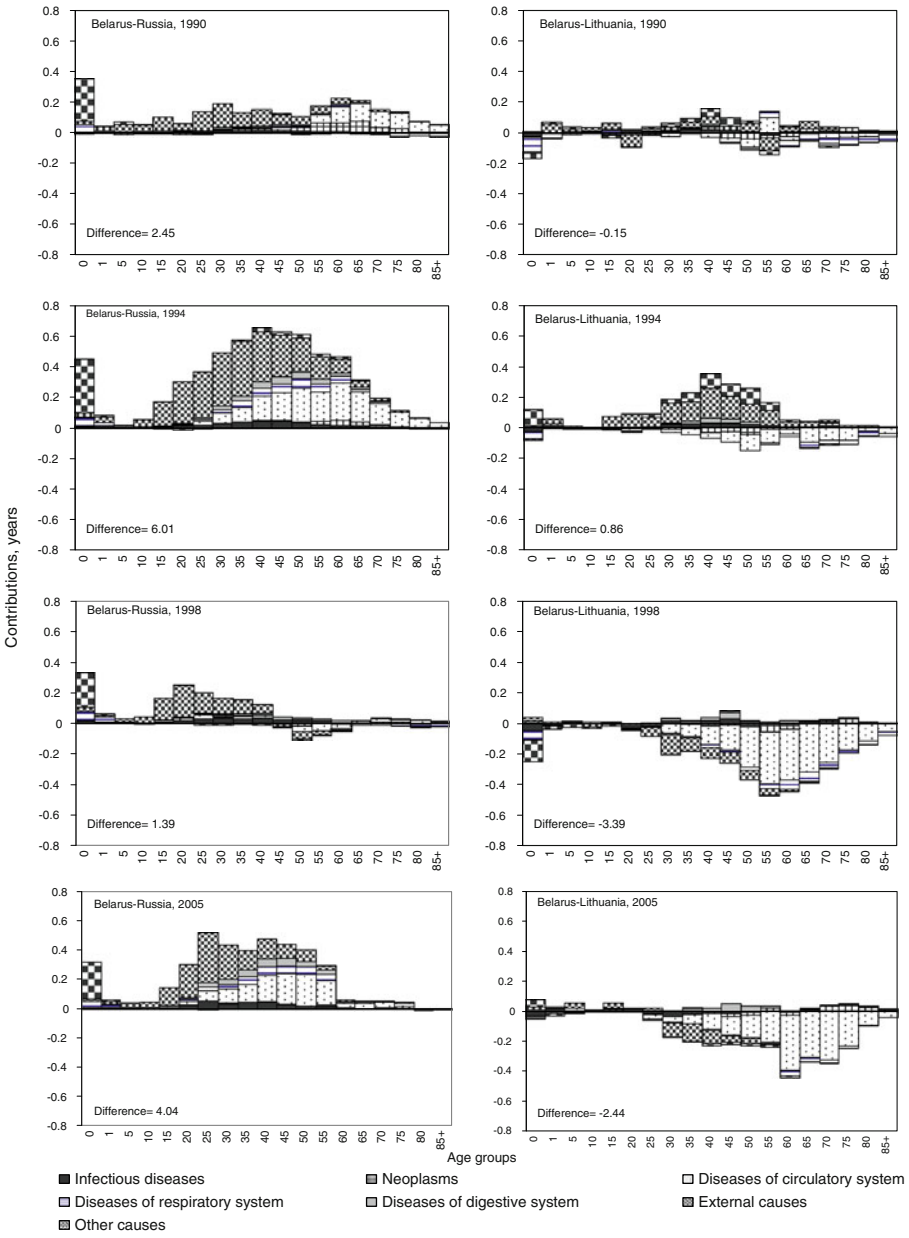

Fig. 3 Age-cause contributions to the difference in male life expectancy at birth between Belarus and Russia, and Belarus and Lithuania; 1990, 1994, 1998, and 2005. (years). *Source*: as in Fig. 2

increased advantage for Belarus, which escaped the major fluctuations observed in Russia after the move to a market economy. But they also resulted in a quite different pattern of ages and causes. Apart from infant mortality, in which Belarus

maintained the same advantage throughout the whole period, the gap between Belarus and Russia was now almost exclusively attributable to younger adult ages (from 20 to 55), even though the impact of external causes was still more prominent at younger ages than that of cardiovascular diseases. Whereas in 1990, cardiovascular diseases contributed to the gap only after age 55, by 2005, they also contributed at ages 40–55. Conversely, while external causes were more important before age 40 in 1990, they had, by 2005, become important up to age 50, and also more concentrated around ages 25–34. Very little difference was observed at ages 1–15, or at ages 60 and above. In 2005, the difference was largely attributable to working ages.

Comparing Belarus to Lithuania, we see that the changes between 1990 and 2005 were even greater. Indeed, in 1990, there was neither a difference in life expectancy levels, nor a large contrast between the two countries in terms of age- and cause-specific patterns. Except for a non-negligible Lithuanian advantage in terms of infant mortality, many small cause-specific differences resulted in either Belarus or Lithuania having minor advantages based on age. However, the considerable advantage enjoyed by Lithuania in 2005 could be primarily explained by a huge cardiovascular gap at the oldest ages (especially at ages 50–80). The differences at ages below 30 were very tiny, and the not insignificant role of external causes, concentrated at ages 30–45, appeared to be secondary when compared to the effect of the difference in cardiovascular diseases.

Naturally, as was the case in the comparison between Belarus and Russia, the final differences that emerged between Belarus and Lithuania also came about through chaotic intermediate changes. In 1994, a huge contrast was observed at adult ages between a large Belarusian advantage in terms of external causes, and a moderate disadvantage in terms of cardiovascular diseases. This situation differed greatly from the Belarus/Russia comparison. The contrast between the two comparisons was even greater in 1998. At that time, Belarus was the winner against Russia, and was the loser against Lithuania in all areas, such as infant mortality, external causes at adult ages, and especially cardiovascular diseases at all ages above age 30, including the very old ages, up to 85 and above. The situation observed in 1998 may be attributed to the fact that Lithuania had finally started to take part in the cardiovascular revolution, while Belarus had not yet done so. Indeed, the situation observed in 2005 is an indication that the spectacular success achieved by Lithuania in the late 1990s was still fragile, since the 2005 comparison is a bit less favorable to that country, but the age and cause pattern of the difference is very similar, and confirms that Belarus did not succeed in reducing cardiovascular mortality.

Finally, while the life expectancy level of Belarus is currently roughly half-way between the levels of Russia and Lithuania, the respective distances are not related to the same age- and cause-specific differences. Three specific differences (infant mortality, external causes at young adult ages, and cardiovascular diseases at middle adult ages) place Belarus at an advantage compared with Russia; while cardiovascular mortality alone, but at much older ages, places Belarus at a disadvantage compared with Lithuania.

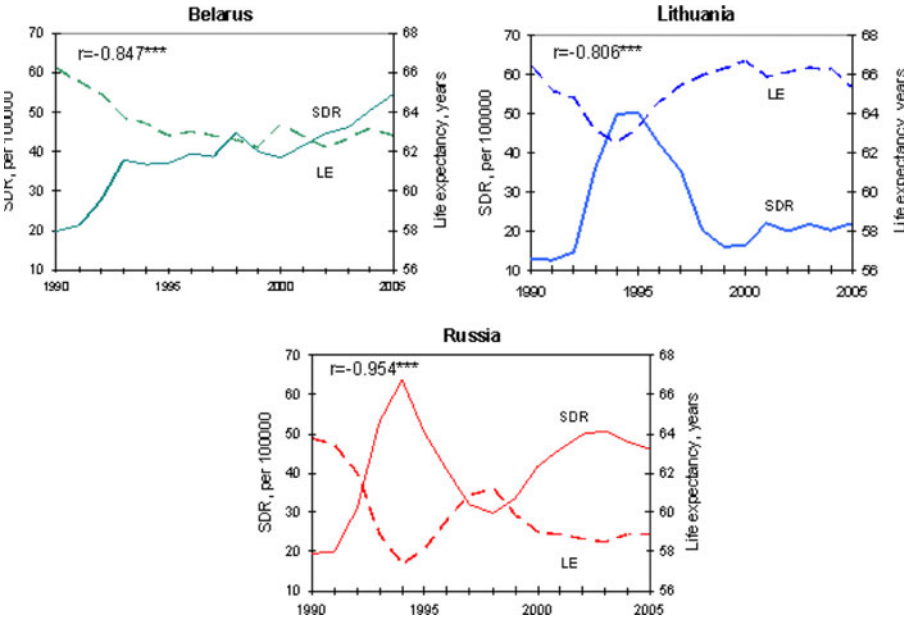

Fig. 4 Association between male life expectancy at birth and the SDR from accidental alcohol poisoning in Belarus, Lithuania, and Russia; 1990–2005. *Source*: As in Fig. 2. *Note*: *SDR* standardized death rate from accidental alcohol poisoning, *LE* male life expectancy at birth. *** Pearson correlation at 0.01 level of significance

External causes and, in part, cardiovascular mortality (at least at young adult ages) are also known to be closely associated with risky behavioral patterns, such as the excessive alcohol consumption (McKee and Britton 1998). Mortality from accidental alcohol poisoning (obviously correlated with alcohol consumption) was found to be a good predictor of overall mortality in Russia (Shkolnikov and Nemtsov 1997). The same relationship holds for both Belarus and Lithuania, as shown in Fig. 4.

In 1990, the male standardized death rate (SDR) from accidental alcohol poisoning in Belarus and Russia was twice as high as in Lithuania. By 1994, the rate had increased about 4-fold in Lithuania, more than 3-fold in Russia, and around 2-fold in Belarus. During 1994–1998, mortality from this cause of death declined steadily in Lithuania and Russia, so that by 1998 it had almost returned to the level of 1990. By contrast, mortality from accidental alcohol poisoning in Belarus rose sharply in 1994, and remained at approximately the same level until 2000. Thereafter, it started increasing rapidly to the extent that in 2005 the SDR from accidental alcohol poisoning exceeded that of Russia. Given the historical importance of alcohol in influencing overall mortality, this tendency severely compromises the prospects for future demographic growth in Belarus.

Nevertheless, alcohol consumption is not the only reason why Belarusian life expectancy is between that of Russia and Lithuania, and it is not even the most

important one. It is very likely that the socioeconomic transformations initiated in the early 1990s have much more fundamental and complex links with mortality trends. Is it possible to identify these links using some socioeconomic indicators?

5 Impact of Socioeconomic Changes

Prior to the dissolution of the Soviet Union, Belarus, Lithuania, and Russia shared many similarities in terms of economic performance and living standards. They were considered to be among the most developed and prosperous regions relative to other republics of the USSR. In 1990, Lithuania and Russia enjoyed the highest Human Development Index (HDI) in the USSR. Their values exceeded 0.8, meaning that living standards in these republics were not far from those of Western countries. Belarus was slightly behind, with an HDI of 0.793 (UNDP 2009).

The collapse of the USSR in 1991 had dramatic socioeconomic consequences for all the former Soviet republics. While they differed in magnitude and were specific to each newly independent state, all the former republics faced a similar set of challenges in the early years of the transition period, including a deep economic crisis accompanied by macroeconomic instability, inefficiencies of the state-owned enterprises, hyperinflation, unemployment growth, and a drastic decline in the well being of the population. At this critical point, Russia and Lithuania chose more radical forms of economic and political transformations, which led to massive privatization campaigns and the establishment of fully functioning market economies. As noted by experts at the European Bank for Reconstruction and Development (EBRD), the reforms were more sustainable and systematic in Lithuania than in Russia (EBRD 1999). Meanwhile, in an attempt to insulate its population from the pain of reforms, Belarus chose the policy of gradualism. This involved preserving the main features of the old-fashioned planned economy and methods of the administrative regulations established under the Soviet rule, such as protecting jobs and wages, maintaining state control over most production resources, and large social expenditures and subsidies (World Bank 2008). Today, the economic system of Belarus has a number of features which make it very different from most transition economies. Among them are: (i) the dominance of the state-owned enterprises; (ii) the high degree of government intervention in enterprise operations, including the preservation of some elements of central government planning of output, wages, and employment; (iii) the high level of taxation; and the major budget redistribution of funds aimed at supporting traditional firms and employment (World Bank 2005)

The process of transition to a market economy is obviously far from complete in Belarus. According to the European Bank of Reconstruction and Development (EBRD), Belarus remains one of the slowest-reforming countries among all the transition economies. The EBRD developed a methodology for ranking countries by the progress made in market reforms (see EBRD transition reports for more details). The following figure depicts the position of Belarus relative to Russia and Lithuania, and to other republics of the former USSR on the path to becoming market economies (Fig. 5).

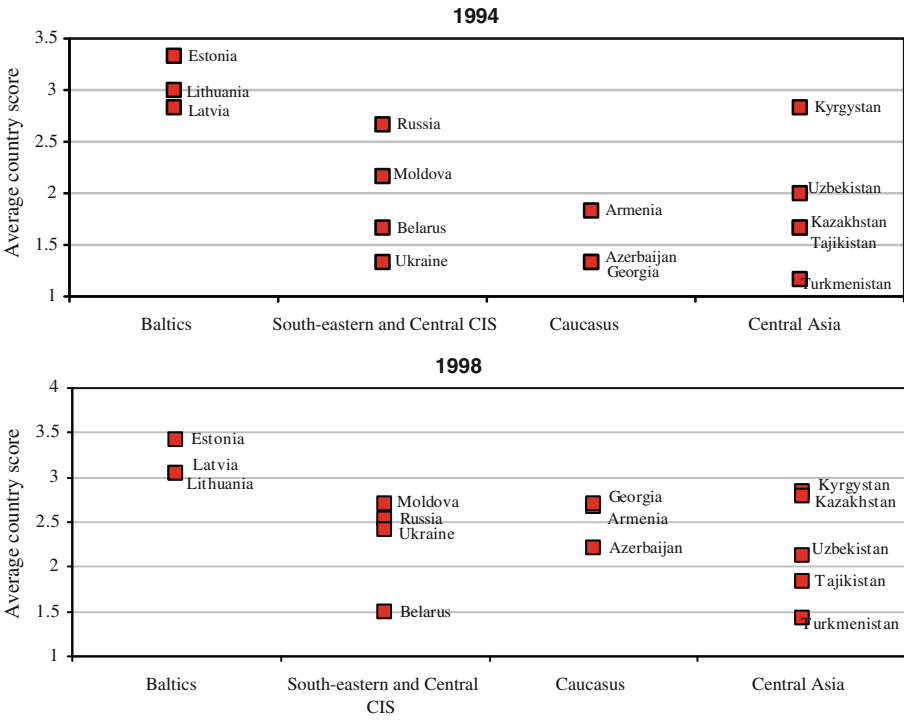

Fig. 5 Regional patterns of reforms by countries of the former USSR in 1994 and 1998. *Source*: EBRD 1994 and 1998. *Notes*: *CIS* commonwealth of Independent States, the calculation method for the average country score is provided in the appendix

In 1994, Belarus had one of the lowest average country scores among the former Soviet republics. By 1998, it occupied the place next to Turkmenistan, which had the last position not only in the former USSR, but also among all the transition countries in Central and Eastern Europe.

The higher the speed and the less systematic the reforms, the more painful they may be for people, especially during the initial stage. Economic reforms may influence health through the following: (i) macroeconomic instability, which in turn may cause stress and anxiety; (ii) changes in prices, which may put constraints on consumption behavior; and (iii) poverty, erosion of the social security system, and deterioration of the public health infrastructure (Brainerd 1998). These findings may appear to suggest that the slower (compared to Russia and Lithuania) mortality increase seen in Belarus during 1990–1994 was associated with the less radical and slower market reforms implemented in that country. However, this does not necessarily imply that there is a clear association between socioeconomic changes and mortality. The mortality response may be different from one population to another, as it depends heavily on initial conditions. The case of the Czech Republic is very illustrative: during the period of economic transformation, life expectancy in

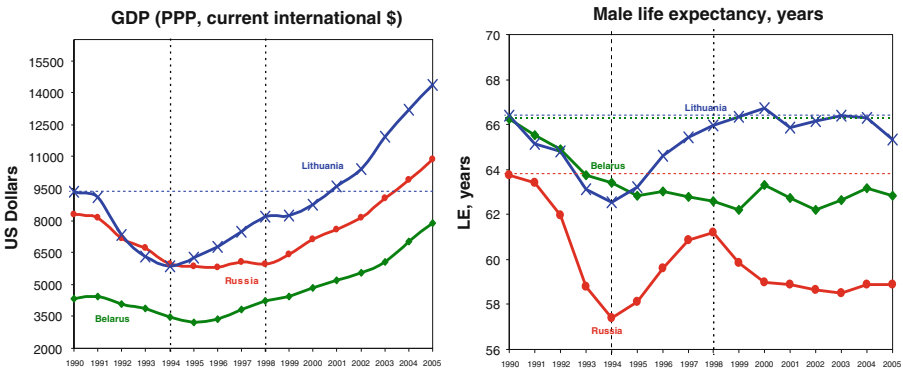

Fig. 6 GDP per capita (PPP US$) and male life expectancy at birth in Belarus, Lithuania, and Russia during 1990–2005. *Sources*: TransMonee Database, Human Mortality Database. *Note*: the correlation between GDP per capita and male life expectancy is not statistically significant ($r = 0.195$, sig (2-tailed) $= 0.184$, $N = 48$)

this country actually increased (Brainerd 1998). The same could be said of Poland. But past conditions in communist Central European countries were not identical to those of the former Soviet Union republics. And, while the very different paths chosen by Belarus, Russia, and Lithuania could explain the differences between the mortality trends of Belarus and those of Russia and Lithuania in the early 1990s, they do not explain the more recent diverging trends.

Even if available socioeconomic indicators are not sufficient to draw firm conclusions, they do capture the major changes occurring in the former Soviet republics. For example, the huge fall in the gross domestic product (GDP) per capita (PPP US$)[9] at the beginning of 1990 indicates the depth and severity of the economic recession (Fig. 6). The magnitude and duration of the crisis differed from country to country. Lithuania experienced the sharpest drop in per capita income, but managed to recover earlier. By contrast, Belarus had the slowest decrease in annual per capita income, which may explain why the mortality increase in this country was less dramatic than in Russia and Lithuania. Yet despite an increase in GDP, the health situation in Belarus deteriorated steadily. Meanwhile, by 1998, life expectancy in Russia had almost caught up to that of Belarus, even though Russia had not made any progress on its GDP per capita. Furthermore, from 1998 to 2000, while GDP per capita was going up in the three countries, life expectancy declined in Russia, stagnated in Belarus, and increased in Lithuania. Finally, from 2002, while GDP was rising even more steadily in the three countries, life expectancy stagnated in all of them. Thus, there is no direct relationship at all between GDP per capita (PPP US$) and life expectancy changes.

[9] Purchasing Power Parity. A rate of exchange that accounts for price differences across countries, allowing international comparisons of real output and incomes. PPP US$1 has the same purchasing power in the domestic economy as US$1 has in the United States (source: United Nation Development Programme (UNDP) 2009).

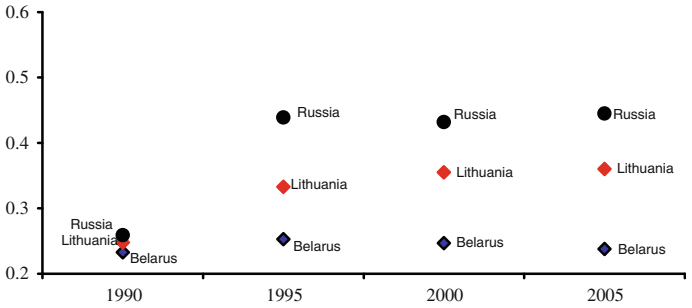

Fig. 7 Gini coefficient in Belarus, Lithuania, and Russia, 1990–2005 *Source*: WIID2 (2009)

Indeed, the same level of GDP per capita can result from many different situations in terms of individual wealth and living standards. Individual health is not linked to GDP directly, but to its distribution among individuals. Even in the richest countries, some portion of the population is subject to relative deprivation because of their low incomes and low social status. Income inequality measured by the Gini coefficient[10] at the population level may be an important indicator for explaining health differentials between countries of similar GDP per capita (Wagstaff and Van Doorslaer 2000). The changes which occurred in distributional patterns of income in Belarus, Lithuania, and Russia in recent decades are shown in Fig. 7.

With the collapse of the USSR, disparities in income distribution increased tremendously in all countries except Belarus, a country where market-oriented reforms were very limited, and where one might expect income distribution to have remained more equal. By contrast, the growth in income inequality in Russia during 1990–1995 was unprecedented. It indicates the extent of the socioeconomic disparities experienced by the Russian population during the initial years after the dissolution of the USSR, and mortality dynamics during this time seem to respond to the abrupt social and economic differentiations. The degree of inequality in Russia compared to other countries is remarkable. In 1995, the income of the richest 10% of the population was more than 30 times higher than that of the poorest 10%! The corresponding ratio was 10 in Lithuania and 5 in Belarus (WIID2 2009). Clearly, the stable level of income inequality in Belarus may explain the specifics of mortality dynamics in this country. However, it is equally clear that inequality in income distribution alone does not provide the whole explanation, since Lithuania, the only country of the three in which life expectancy is almost as high today as it was 15 years ago, is also a country in which the Gini coefficient has increased

[10] Standard economic measure of income inequality, based on Lorenz Curve. A society that scores 0.0 on the Gini scale has perfect equality in income distribution. The higher the number over 0, the higher the inequality, and the score of 1.0 (or 100) indicates total inequality, in which only one person corners all the income. Named after its inventor, the Italian statistician Corrado Gini (1884–1965). Also called Gini coefficient or index of concentration (source: http://www.businessdictionary.com/definition/gini-index.htm).

considerably. In Fig. 7, Lithuania is midway between Belarus and Russia, so why is life expectancy in Belarus between the levels of Russia and Lithuania?

Another aspect of national income distribution could be of interest here. Even if it is not a guarantee of good health care performance, the proportion of GDP devoted to the health care system can be an indicator more directly related to life expectancy than GDP per capita, or even the Gini coefficient. In 1990, total health expenditures in the three countries were at about the same level, and varied between 160 and 180 PPP US$ per capita. By 1995, per capita health expenditures had been almost halved in Russia, while Belarus and Lithuania increased health spending slightly. In 2000, the per capita health expenditures of Belarus and Lithuania were again at about the same level, or 445 and 426 US$, respectively. Russia was far behind, with 243 US$ per head (HFA-DB). Unlike Russia, both the authoritarian regime in Belarus and the democratic one in Lithuania managed to avert institutional collapse. Health expenditures may indicate the commitment of the state to fulfilling its social obligations. In this respect, there is a huge difference between Russia on one hand, and Belarus and Lithuania on the other. The difference in the amount of investment in health care between Belarus and Russia might at least partially explain the gap in life expectancy levels between these two countries. However, once again, how can we explain the fact that Lithuania, but not Belarus, achieved success in combating cardiovascular mortality, given basically the same level of health expenditures in both the countries? It appears that it is not just the amount of money that is invested in health that matters, but also other aspects, such as the efficient use of resources, equity, accessibility, affordability, and quality of care.

On these aspects, there is also considerable diversity between the countries. Belarus has maintained the system of providing free basic care to the entire population. This was achieved by introducing incremental reforms to the inherited Semashko health care system. Despite some achievements (e.g., reduction of infant and maternal mortality), the reforms have not been very successful in tackling non-communicable diseases. More fundamental changes are required to improve the quality and efficiency of services (Richardson et al. 2008).

Like in Belarus, the health care system of Lithuania remained relatively stable at the time of severe economic crisis. In the initial stages, health care reforms were implemented gradually, with the awareness that they should follow the structural changes of the economic sector. Since 1997, the financing of health care in Lithuania has progressively moved toward a stationary health insurance system based on a combination of insurance contributions and tax revenues. The steady economic growth accompanying Lithuanian socioeconomic development since 1995 created the conditions necessary for the implementation of this new system. The health status of the population improved, as indicated by life expectancy at birth, which, in 1998, exceeded its pre-reform level. However, for Lithuania to develop a fully functional and efficient health care system, a number of issues should be addressed. Among them are inequalities in regional allocations of resources, growing private health care expenditures, and high fixed costs due to large numbers of physicians and hospital beds (Health Care Systems in Transition: Lithuania 2000).

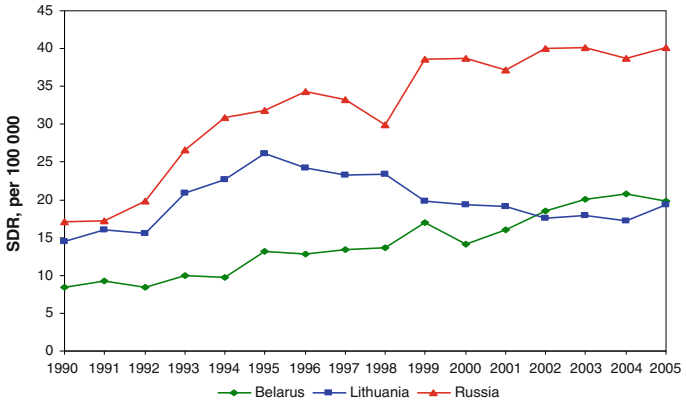

Fig. 8 Standardized male death rate from tuberculosis in Belarus, Lithuania, and Russia, 1990–2005 (per 100 000). *Source*: HFA-DB (2009)

The health care reforms in Russia were intended to preserve access to a basic package of care for the whole population, but they failed to meet this goal. The Russian health care system has been increasingly financed "out-of-pocket" and "under-the-table." There are also growing disparities in economic developments across regions of Russia, which further contribute to the inequity in service provision. Russia experienced a dramatic downturn in health indicators associated with the economic chaos of the early 1990s. Effective health care delivery was interrupted. Today, the Russian health care system is still very much in transition. Due to the incomplete implementation of health insurance legislation and the only partial functioning of insurance companies, the health care system has not made the anticipated efficiency gains (Tragakes and Lessof 2003).

Traditionally, some causes of death are more sensitive than others to the efficiency of health policies. For example, during the final stage of the long fight against infectious diseases, mortality by tuberculosis was quite a good indicator of the performance of health care systems. The former USSR demonstrated great efficiency in reducing the number of deaths from tuberculosis, and from many other infectious diseases as well, until the mid-1960s. Thanks to this success, life expectancy levels in all the European republics of the USSR had, at that time, almost caught up with those of the Western world. By contrast, the severe social and economic crisis of 1992–1993 resulted in a dramatic increase in tuberculosis mortality in Russia and Lithuania (Fig. 8), reflecting the crisis in the former health system.

Meanwhile, Belarus kept its tuberculosis mortality rate stable. However, over the last 10 years, trends in tuberculosis mortality have been going up, not only in Russia (after a short period of post-crisis recovery), but also in Belarus, while declining in Lithuania. Belarus was unsuccessful in maintaining the performance of the health care system inherited from the USSR, and began to experience the long-term deterioration observed in countries like Russia (Meslé et al. 2000) or Ukraine

(Meslé and Vallin 2003) since the mid-1960s. By contrast, once the shock of the move to a market economy had passed, the new Lithuanian health system was successful in further reducing tuberculosis mortality.

Considering the difficulties faced by countries like Russia and Belarus in simply preserving the benefits inherited from the Soviet time in the area of infectious disease control, it is not surprising to observe that their health care systems are unable to tackle efficiently the much more difficult problem of cardiovascular disease. To succeed in that field, it is not only necessary to invest more money in the health care system but also to adopt new strategies, at both the collective and the individual levels, which were not familiar to the old Soviet system partially preserved in Belarus, and are not at all on the agenda of post-Soviet Russia. By contrast, it seems that Lithuania was on the way to adopting these strategies in the late 1990s, even if the 5 years that followed show that its success remains quite fragile.

Linking mortality trends with ongoing socioeconomic changes is not a simple task, and does not only depend on the availability of reliable data. The main features of the Belarusian economic system have little in common with those found in the neighboring countries. Clearly, in countries with a market economy, the mechanisms whereby national income influences life expectancy via the income of the poor and via public health expenditures differ from those in countries with regulated economies. All these factors should be taken into account when comparing countries and analyzing the relationship between socioeconomic development and mortality. Furthermore, income, income inequality, and health expenditures are important mortality determinants, but they are just a few variables among many others. While admitting the relevance of economic variables, Sen (1998) emphasizes "their severe inadequacy in capturing many of the causal influences on the quality of life and the survival chances of people."

6 Conclusions and Discussion

Three main conclusions can be drawn from the divergence of mortality trends among the countries, based on a comparison of age- and cause-specific mortality and of some available socioeconomic indicators. The first conclusion is quite clear: differences in the speed and the extent of the move to a market economy resulted in quite different effects on mortality trends. Market reforms influence the health and mortality of individuals through the unstable socioeconomic situation, which produces stress and anxiety, and modifies people's lifestyles. The magnitude of negative changes differed greatly between the three countries here studied. Russia experienced the sharpest mortality growth in the beginning of the 1990s, caused by painful market reforms that were not accompanied by the creation of strong market institutions or by a commitment of the state to fulfill its social obligations. Lithuania also experienced radical market reforms, but, unlike Russia, avoided institutional collapse, and managed to maintain a relatively stable

health care system at a time of severe economic recession. As a result, mortality growth in Lithuania in the early 1990s was less dramatic. By contrast, Belarus, which followed the slowest transition path, suffered the lowest increase in mortality. Nevertheless, the experience of the three former Soviet republics does not necessarily imply that more radical liberalization is correlated with higher mortality. The association between economic policy and health in the transition countries is complex and rather country-specific. In some transition countries, such as Poland and the Czech Republic, the implementation of rapid reforms was not accompanied by growing mortality (Brainerd 1998). Stuckler et al. (2009) attribute this fact to the impact of social capital, a mediating variable between economic change and mortality. They argue that, with increasing social capital, the effect of rapid privatization on adult male mortality decreases linearly. Differences in initial economic conditions between countries can also predetermine the success of market reforms, and, consequently, affect health. Popov (2007) demonstrated that more than half of the differences in the economic performance of transition countries can be explained by "uneven initial conditions such as the level of development and pre-transition disproportions in industrial structure and trade patterns." In some cases, drastic economic measures can be considered successful, even though at the initial stages they had a negative impact on health. The case of Estonia shows that painful reforms can prove to be justifiable in the long run. Like Russia and Lithuania, Estonia underwent quite radical privatization, and experienced very sharp mortality growth during 1990–1994. However, unlike other former Soviet republics, Estonia managed to recover quickly, and achieved very impressive progress in life expectancy. In 2005, male life expectancy in Estonia was 67.3 years, compared with 58.9 years in Russia, 62.8 years in Belarus, and 65.4 years in Lithuania. By contrast, in 1990, male life expectancy in Estonia (64.7) was 1.6–1.7 years lower than in Lithuania and Belarus, and just about 1 year higher than in Russia (Human Mortality Database). Successful reforms of the health system implemented in the early 1990s are viewed as the key factor in the recent steady increase in life expectancy in Estonia (Koppel et al. 2008).

The second conclusion is that no socioeconomic determinant can fully explain the divergence observed between the three countries after the immediate effects of the 1992–1993 crisis. Apart from the period 1990–1994, the correlation between GDP per capita and mortality is very weak. The degree of income inequality measured by the Gini coefficient and the dynamics of total health expenditures could partly explain the difference between Belarus and Russia, but they do not explain the difference between Belarus and Lithuania. It seems that recent diverging trends are more closely linked to the efficiency of health systems and policies than to the amount of money invested in health. A careful examination of mortality trends by particular causes of deaths, such as tuberculosis, can be very useful in investigating the matter. Clearly, even though it is among the main causes of death amenable to medical care (Nolte and McKee 2003), tuberculosis alone cannot fully characterize the performance of the health care system. Other causes of death known to be amenable to health care (e.g., diabetes mellitus, intestinal infections, and epilepsy) should be taken into account. Estimating

mortality attributable to the performance of health care for each country, and then comparing the results, seems to constitute an appropriate approach for further research in this direction. Furthermore, the differences in the performance of health care systems alone may not fully explain the diverging mortality trends between the three countries; other factors, such as different attitudes toward health seeking, may also play a role (Balabanova et al. 2004).

Finally, the initial advantage enjoyed by Belarus thanks to its choice of a slow and an incomplete transition to a market economy now appears to have turned into a prolongation of the unfavorable long-term trends that began in the USSR in the mid-1960s. Belarus does not seem to have overcome the health crisis which began several decades ago, and which accelerated in the early 1990s. One of the typical symptoms of the mortality crisis is the high proportion of violent causes of death among males at working ages, and high cardiovascular mortality. Rapidly rising mortality from accidental poisoning by alcohol is a particularly alarming tendency, given the historical role of alcohol in influencing overall mortality. Even though the policy of gradualism chosen by Belarusian authorities reduced social pressure and slowed mortality growth in the early 1990s, it did not resolve the root problem. Mortality grew more substantially and for longer periods than in Russia and Lithuania. The recent mortality dynamics raise doubts about the future sustainability of demographic development in Belarus. The situation may even deteriorate; sooner or later, Belarus will have to undergo radical economic reforms, which may bring negative demographic consequences. Unlike in Belarus and Russia, the situation in Lithuania shows signs of recovery, particularly in the dynamics of cardiovascular mortality. It was cardiovascular mortality which differentiated the USSR from Western Europe starting in the mid-1960s. Even though life expectancy in Lithuania has not increased in recent years, it is obvious that this country is doing better than neighboring Belarus and Russia. Both these countries, which had very different levels of excess mortality during the transition period, currently appear to be following the unfavorable mortality trends observed in the USSR since the 1960s.

Acknowledgments Research was conducted within the framework of the joint ANR-DFG project "European Divergence and Convergence in Causes of Death". The authors are very grateful to the editors and two anonymous reviewers for their constructive comments and suggestions.

Appendix

Table 4 Progress in transition in Belarus, Lithuania, and Russia, 1994–2005

	Private sector share of GDP in % (rough EBRD estimate)	Enterprises			Markets and trade			Financial institutions		Average score
		Large-scale privatization	Small-scale privatization	Governance and restructuring	Price liberalization	Trade and foreign exchange system	Competition policy	Banking reform and interest rate liberalization	Securities markets and non-bank financial institutions	
	1	2	3	4	5	6	7	8	9	10[a]
1994										
BLR	15	2	2	2	2	1	…	1	…	1.667
LTU	50	3	4	2	3	4	…	2	…	3.000
RUS	50	3	3	2	3	3	…	2	…	2.666
1998										
BLR	20	1	2	1	2	1	2	1	2	1.500
LTU	70	3	4	3−	3	4	2+	3	2+	3.041
RUS	70	3+	4	2	3−	2+	2+	2	2−	2.541
2001										
BLR	20	1	2	1	2	2	2	1	2	1.625
LTU	70	3+	4+	3−	3	4+	3	3	3	3.333
RUS	70	3+	4	2+	3	3−	2+	2−	2−	2.625
2003										
BLR	25	1	2+	1	3−	2+	2	2−	2	1.875
LTU	75	4−	4+	3	4+	4+	3	3	3	3.583
RUS	70	3+	4	2+	4	3+	2+	2	3−	2.999
2005										
BLR	25	1	2+	1	3−	2+	2	2−	2	1.875
LTU	75	4	4+	3	4+	4+	3	4−	3	3.708

Table 4 continued

	Private sector share of GDP in % (rough EBRD estimate)	Enterprises			Markets and trade			Financial institutions		Average score
		Large-scale privatization	Small-scale privatization	Governance and restructuring	Price liberalization	Trade and foreign exchange system	Competition policy	Banking reform and interest rate liberalization	Securities markets and non-bank financial institutions	
RUS	65	3	4	2+	4	3+	2+	2+	3−	2.999

Sources: EBRD transition reports (1994, 1998, 2001, 2003, 2005)

EBRD uses eight indicators (columns 2–9 in the table) to assess the progress in transition. Progress is measured against the standards of industrialized market economies, recognizing that there is neither a perfectly functioning market economy nor a unique end-point in transition. The measurement scale ranges from 1 to 4+, where 1 represents little or no change from rigidly planned economy, and 4+ represents the standard of an industrialized market economy. To further refine the classification system, pluses and minuses are added to indicate countries on the borderline between two categories. The transition indexes should be used with caution. They represent subjective ratings reflecting the EBRD's assessment of both the effectiveness and extensiveness of policy measures, which is sometimes based on incomplete or imperfect information (Merlevede and Schoors 2004)

[a] Own calculations based on the EBRD methodology. The average score represents an unweighted average of eight indicators; 0.33 points are added or subtracted for "+" and "−" ratings

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